Tevatron Dipole Anchor Study Status Report

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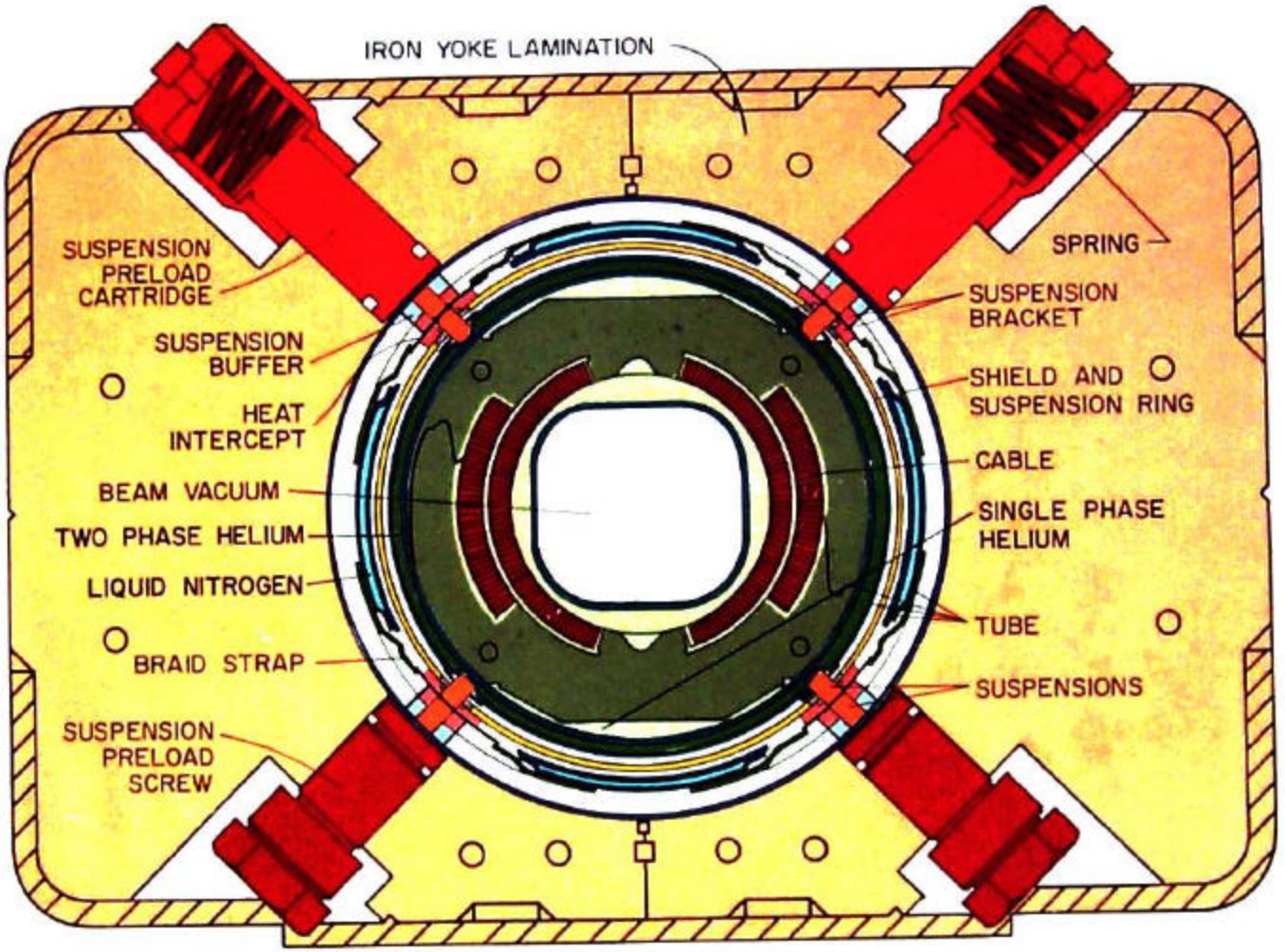
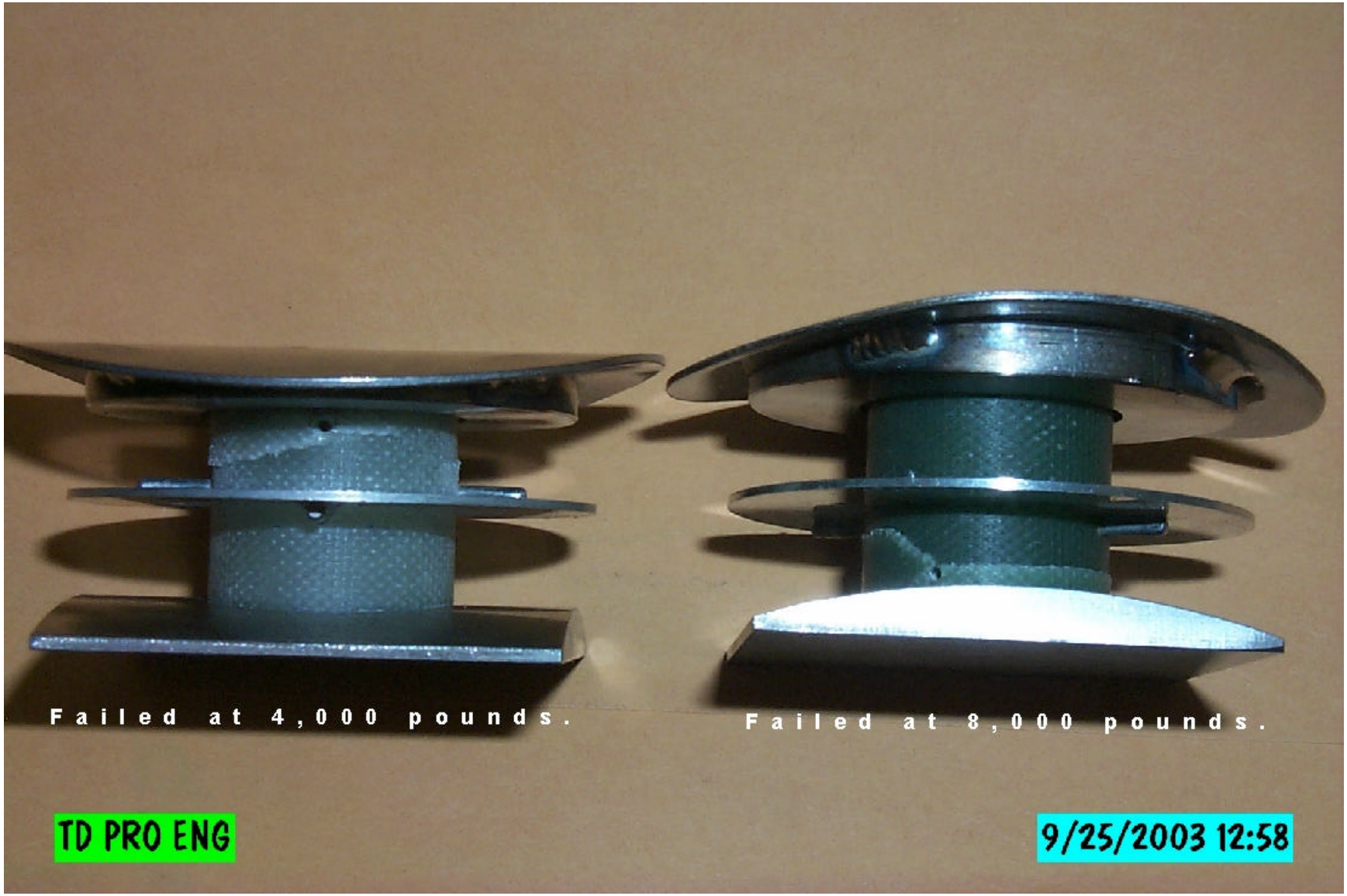
Outline

- Review of anchor structure
- Mechanical data suggesting a problem
- Concerns
- Magnetic measurements to date
- Future activities

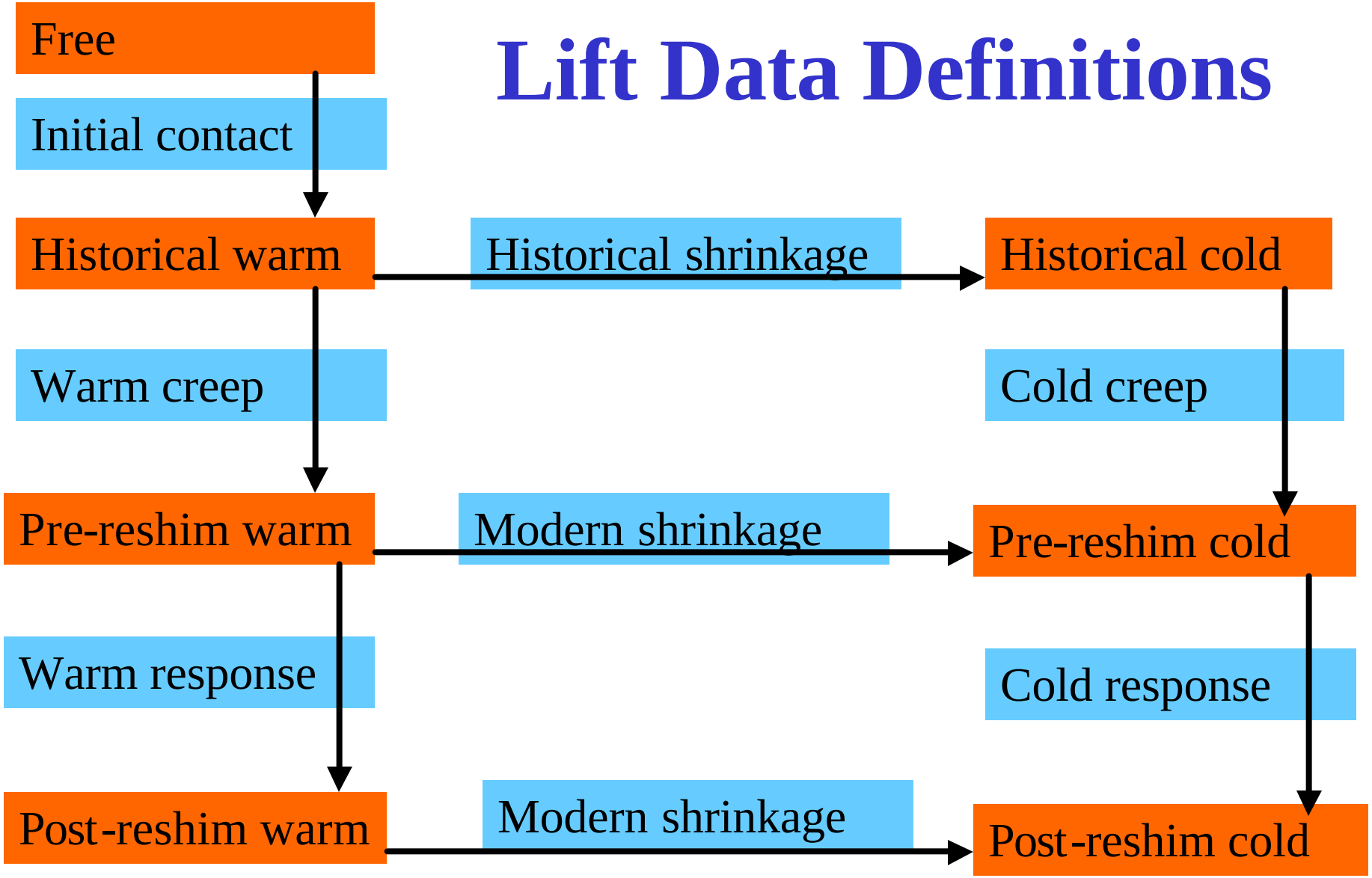
Tevatron dipole cross section



Broken Anchors



Lift Data Definitions

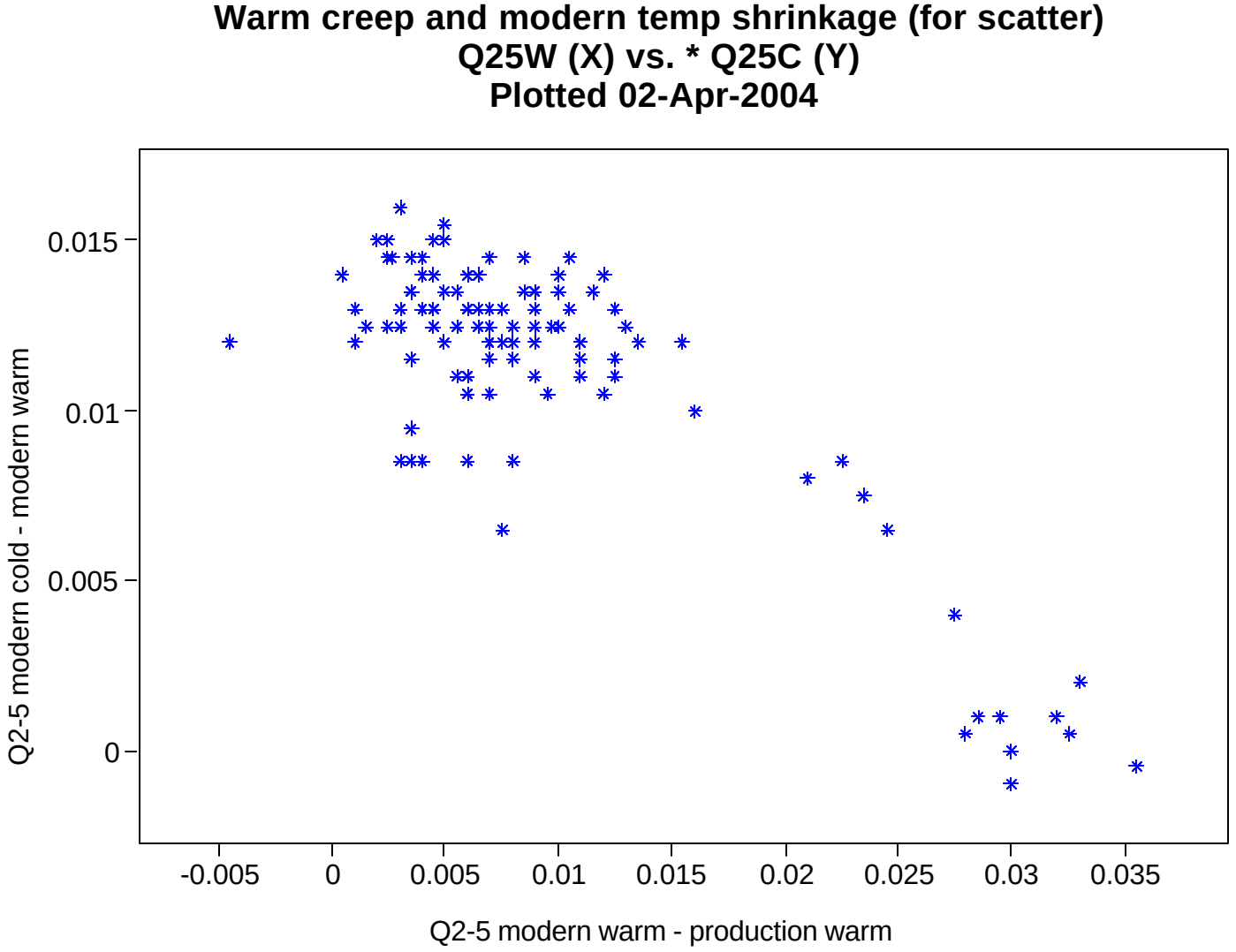


Availability of Lift Data

- Free lift – in travelers, on bolts, some extracted
- Historical warm – in travelers, some extracted
- Historical cold – in travelers, some extracted
- Recent pre-reshim warm – some
- Recent pre-reshim cold – all installed
- Recent post-reshim warm – minimal
- Recent post-reshim cold – some

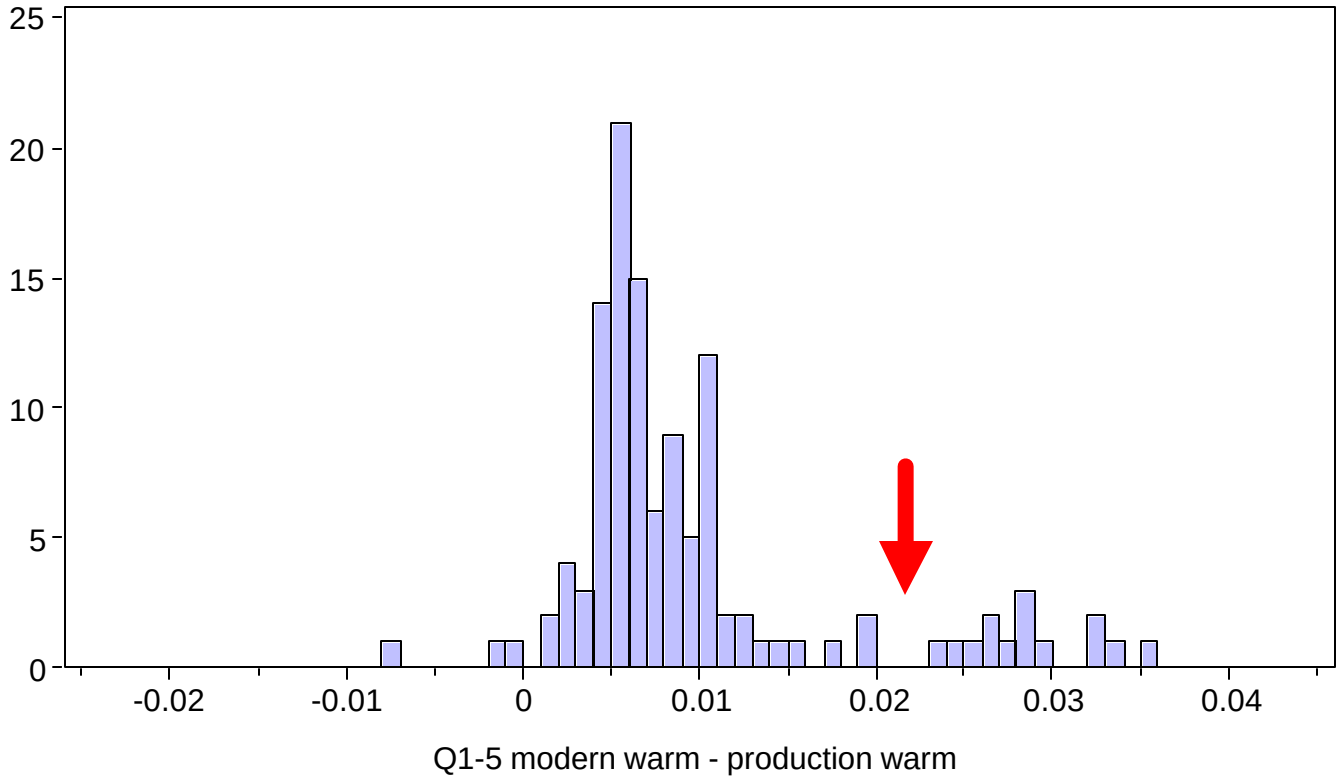
Total magnets considered - 278

Modern shrink vs. Warm Creep



Warm Creep

Creep from warm data
Q1-5 creep from warm data
Plotted 13-Apr-2004

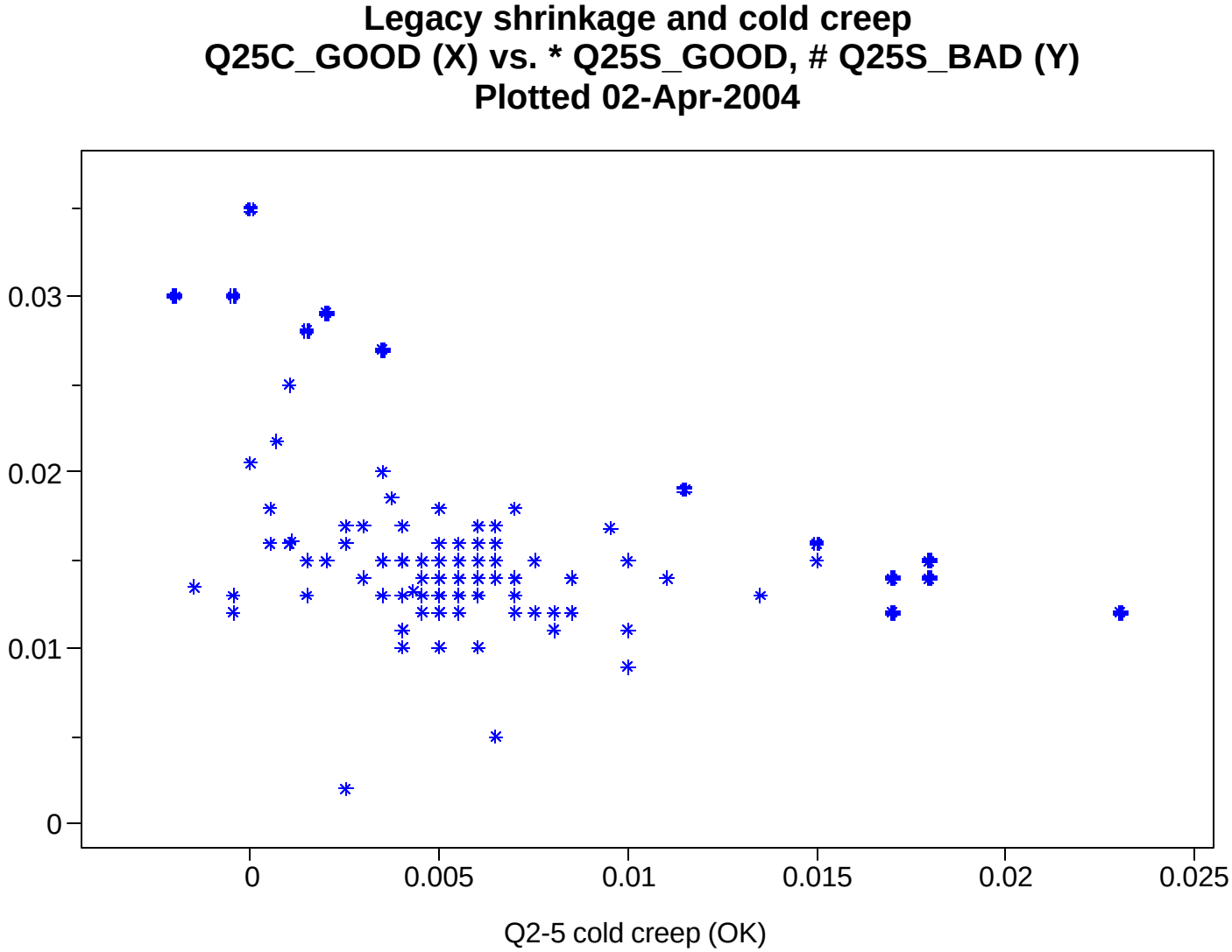


Samples:	118	3sp Lim:	(-.014642, .03331)
Mean:	.0093339		
Std Dev:	.0079919		
Skewness:	1.598		

Findings from 4 warm houses

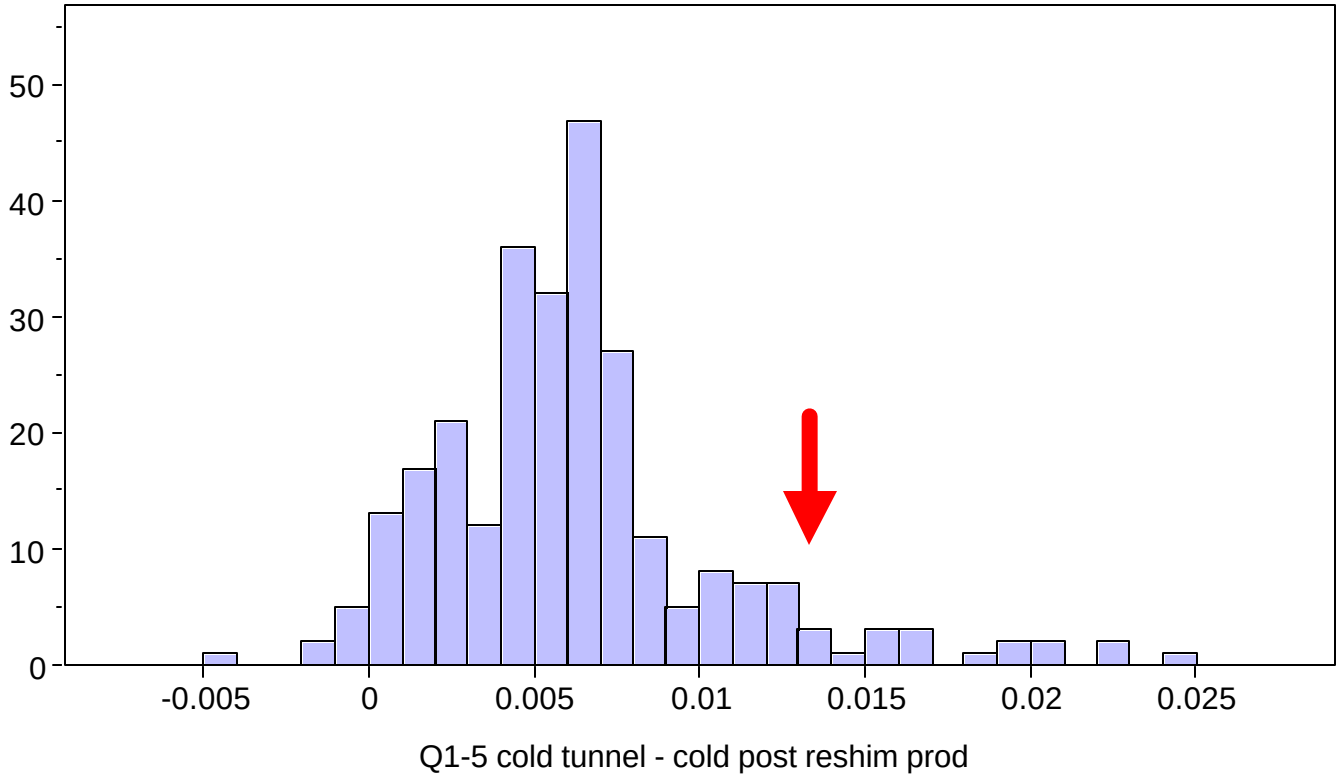
- Warm data – four houses
  - 232 anchors evaluated
  - 27 judged “suspicious”
  - 6 magnets both anchors “suspicious”
- Cold data – same four houses
  - Separation not as clean

Historical Shrink vs. Cold Creep



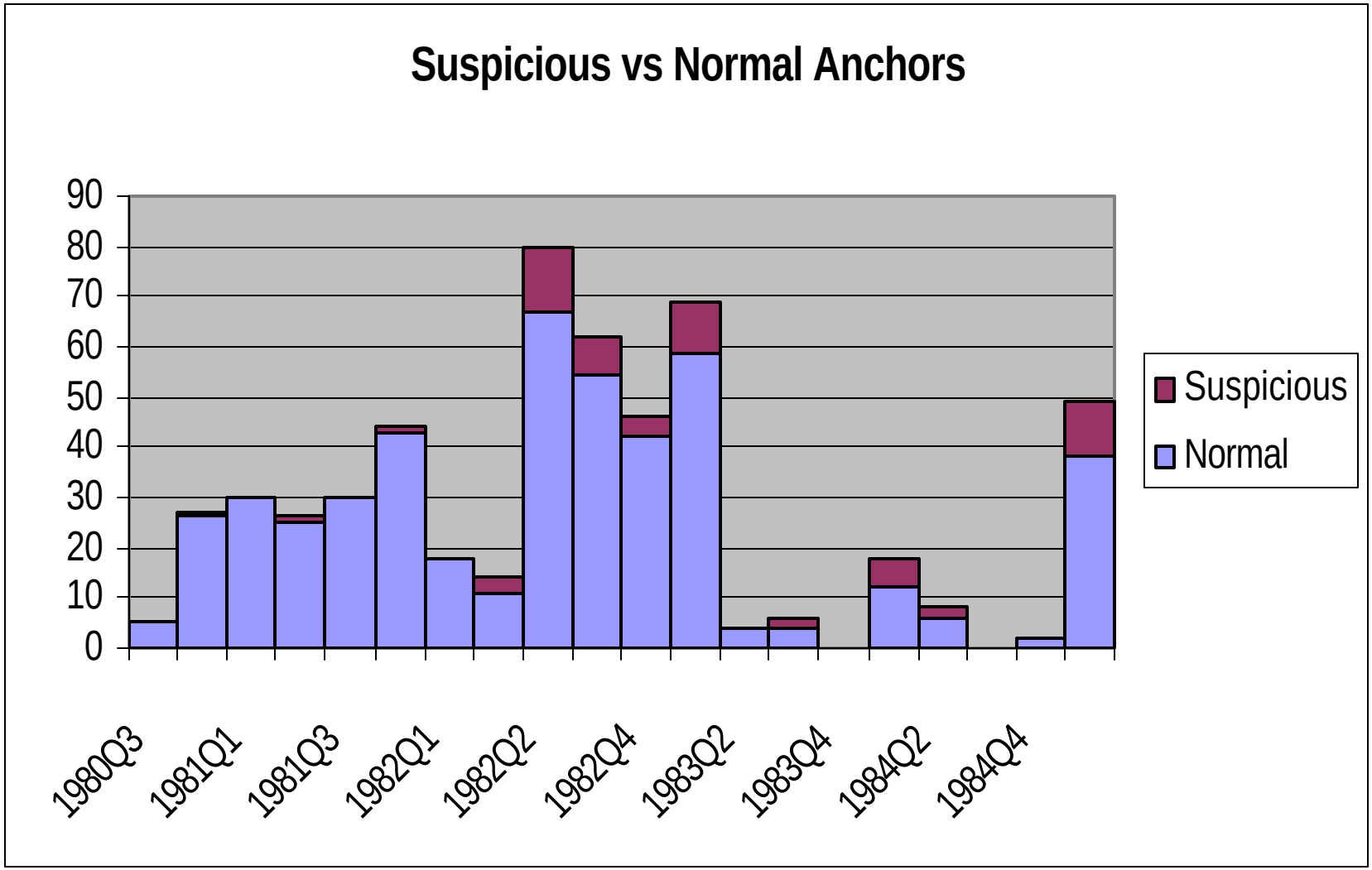
Cold Creep

Creep from cold data
Q1-5 cold creep
Plotted 13-Apr-2004



Samples:	269	3sp Lim:	(-.0073898, .01884)
Mean:	5.72491E-03		
Std Dev:	.0043716		
Skewness:	1.2866		

Production Date



Before and after vendor change

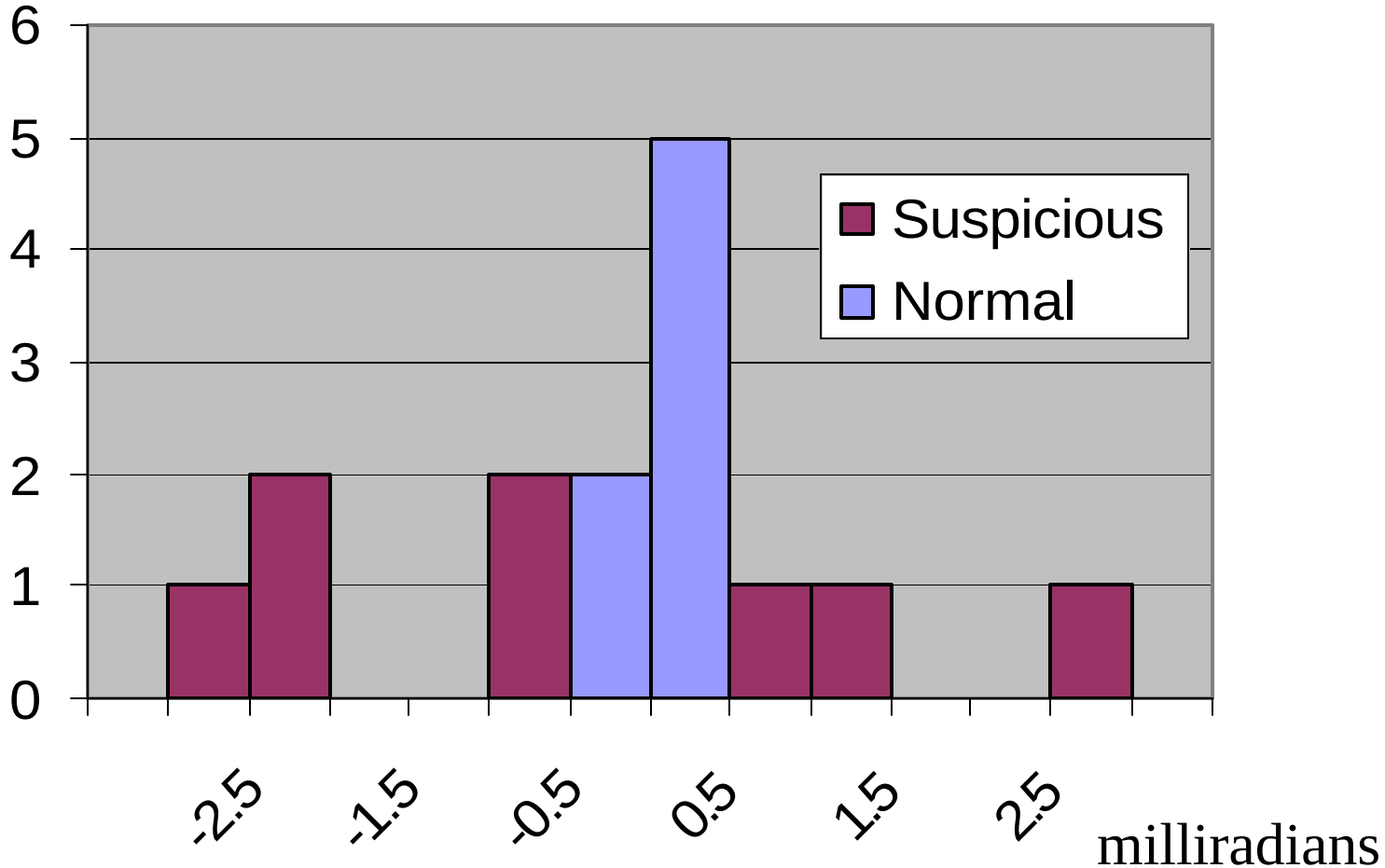
	Magnets	Anchors	Suspicious	Normal	Percent	
Pre	94	180	3	177	2%	**4** ?
Post	184	358	59	299	16%	**3** ?
Total	278	538	62	476	12%	

Concerns

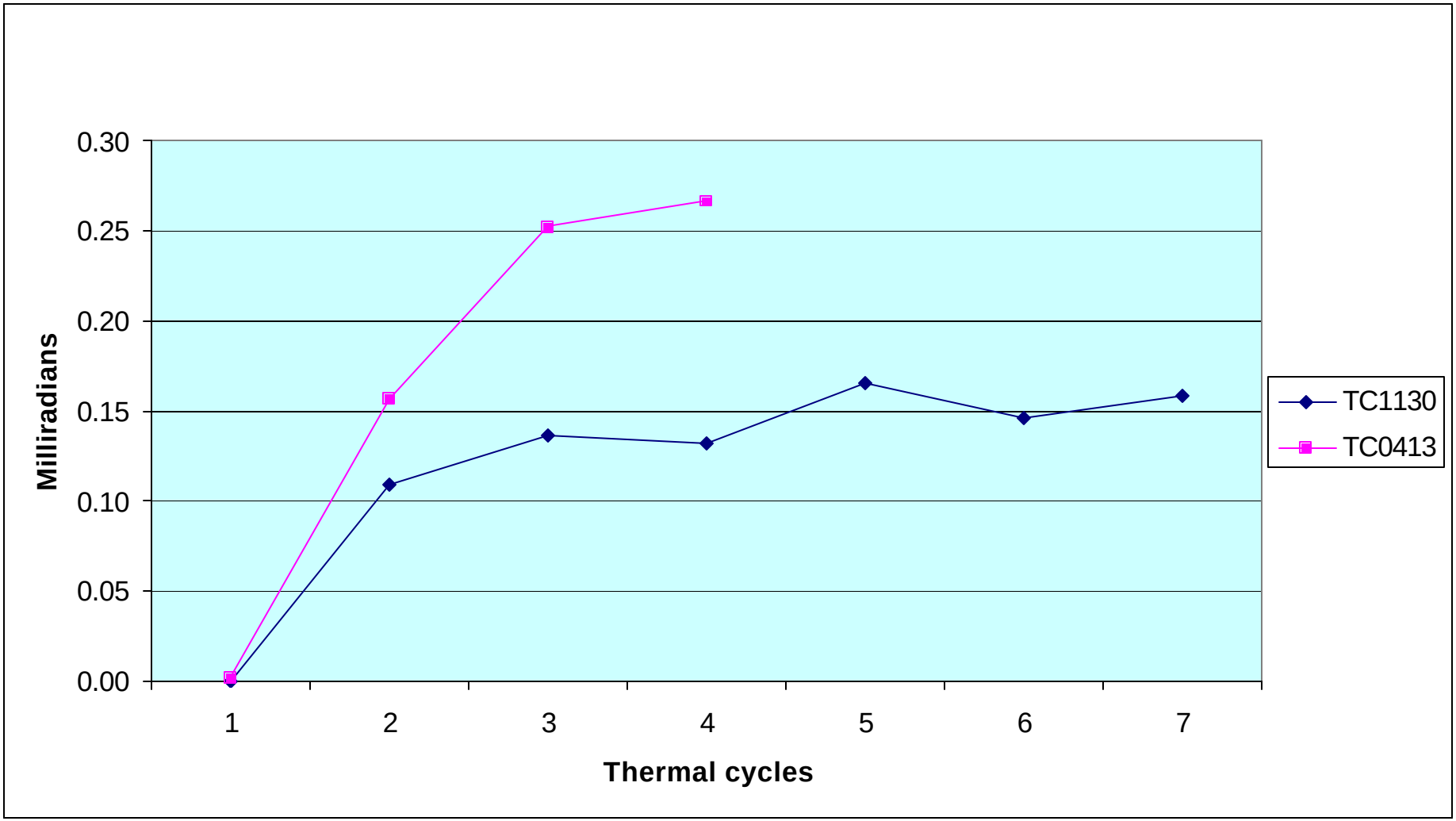
- Has something changed magnetically?
- Is something is changing magnetically?
- Will something change magnetically?

- Field angle – can measure warm, quickly
- Harmonics – must measure cold, slowly

Warm field angle change



Field angle stability



Harmonics data

- Noise difficulties have slowed program
- Time-intensive, want statistics
- Two magnets “abused”
- So far, harmonics seem stable
- Lack of integral data confuses situation

What to do above ground?

- Continue field angle studies (short term)
  - Two more suspicious magnets
  - Several more normal magnets
- Continue harmonics (long term)
  - More suspicious magnets (~5?)
  - More normal magnets (~5?)
- Open magnet(s); look at anchors

? More archeology

What to do in the tunnel?

- Be aware in rolling dipoles
- Remeasure cold lifts annually
- Take warm lifts whenever warm

? Kaiser coil measurements (& archeology)

? Leakage field measurement of angle